

Tomographic Imaging of the Shear Wave Velocity Structure of the Shallow Seabed of the New Jersey Continental Shelf

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LONG-TERM GOAL

The long term goals of this project are to map the three-dimensional, shear-wave velocity structure of the upper 50-100 m of the seabed, to correlate these measurements with geological structure, and to use the spatial variability in shear-wave structure to understand the depositional and erosional processes responsible for the measured structure.

OBJECTIVES

The objective of this work is to carry out a three-dimensional refraction/interface-wave tomography experiment on the continental shelf offshore New Jersey in an area that has been extensively surveyed with high-resolution, seismic reflection imaging techniques. The motivation is our belief that, in many geological settings, the internal structure and geometry of sedimentary facies are sufficiently complex that they can be determined only by carrying out a three-dimensional experiment. Mapping the geometry of these sedimentary facies is an essential component to any study that aims to provide physical constraints on the processes governing sediment deposition and erosion and their evolution over time.

APPROACH

In August/September of 1998, we carried a three-dimensional tomography experiment to image the P- and S-velocity structure of the upper ~50 m of the seabed over an area ~2 km x 0.5 km. The site of the

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proposed experiment was a subset of the area surveyed by *Davies et al.* [1989]. The 3-D seismic reflection experiment carried out by *Davies et al.* [1989] has resulted in a set of superb 3-D images of the reflectivity structure of the upper ~30 m of the seabed in this area. In particular, the images show clearly a system of buried meandering channels associated with a low stand of sea level. The channels are 1-7 m below the seafloor, and are typically 100 m wide and up to 3-4 m deep. The tomography experiment was located over these buried channels.

The experimental procedure was to lay out 8 SWOBS (Shallow Water On-Bottom Seismographs) in a two dimensional grid. The SWOBS sensors consist of a set of three-component seismometers and a hydrophone. The seismometers were custom designed for this type of work, and are capable of recording ground motion without distortion up to frequencies as high as 50 Hz [*Collins et al.*, 1996] . We then deployed a source on the seafloor that directly generates vertically-polarized shear energy. On the completion of shooting, the SWOBS were picked up, redeployed and the shooting pattern repeated.

WORK COMPLETED

This experiment took place in August/September of 1998.

RESULTS

Currently, we are in the process of reducing the vast amount of recorded data.

IMPACT/APPLICATIONS

Dr. Rob Evans (WHOI) carried out towed active-source electromagnetic experiments over the same area that we investigated seismologically. The combination of the two data sets will provide better opportunities to quantify the physical properties of the sub-bottom such as porosity.

The experiment that we performed will have implications for future mapping strategies for the determination of sub-bottom geological structure. The experiment will also be of interest to acousticians investigating low-frequency acoustic propagation loss.

RELATED PROJECTS

Construction of the shallow-water on-bottom seismographs was funded by a DURIP grant (Award# N00014-97-0384). Dr. Rob Evans (WHOI) carried out towed active-source electromagnetic experiments over the same area that we investigated seismologically. The combination of the two data

sets will provide better opportunities to quantify the physical properties of the sub-bottom such as porosity.

REFERENCES

Collins, J.A., G.H. Sutton, and J.I. Ewing, 1996. Shear wave velocity structure of the shallow water sediments in the East China Sea, in press Jour. Acoust. Soc. Am.

Davies, T.A., J.A. Austin, M.B. Lagoe, and J.D. Milliman, 1992. Late Quaternary sedimentation off New Jersey: New results using 3-D seismic profiles and cores, *Marine Geology*, **108**, 323-343.